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3849-301 MAY 2019
Level 3 Certificate in Using and Applying Mathematics
Paper 2: Mathematical Comprehension and Communicating with Mathematics
Written

If provided, stick your candidate barcode label here.

Wednesday 22 May 2019
09:30 – 11:30

Candidate name (first, last)

First

Last

Candidate enrolment number

Date of birth (DDMMYYYY)

Gender (M/F)

Assessment date (DDMMYYYY)

Centre number

Candidate signature and declaration*

- If additional answer sheets are used, enter the additional number of pages in this box. 0 0
- Before taking the examination, **all candidates** must check that their barcode label is in the appropriate box. Incorrectly placed barcodes may cause delays in the marking process.
- Please ensure that you staple additional answer sheets to the **back** of this answer booklet, clearly labelling these with your full name, enrolment number, centre number and qualification number in BLOCK CAPITALS.
- All candidates need to use a **black/blue** pen. **Do not** use a pencil or gel pen, unless otherwise instructed.
- If provided with source documents, these documents **will not** be returned to City & Guilds, and will be shredded. Do not write on the source documents.

***I declare that I had no prior knowledge of the questions in this examination and that I will not divulge to any person any information about the questions.**

You should have the following for this examination
- a clean copy of the pre-release material
- pen with black or blue ink
- pencil
- 30 cm ruler
- calculator
- graph paper.

General instructions
- There are **60 marks** for this paper.
- You have 2 hours to complete this paper.
- Answer all of the questions.
- Write all working out and answers in this booklet.
- There are **two** parts to this paper
  Part 1: Mathematical comprehension
  Part 2: Communicating with mathematics.
- You are advised to divide your time equally between the two parts.
- Final answers should be given to 3 significant figures unless otherwise stated.

You may use
- A scientific or graphical calculator.
- A PC installed with the following standard application office software
  – word processor
  – spreadsheet
  – database
  – graphics and presentation packages.

You must not use
- internet
- email
- internally or externally saved files
- mobile phones.

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Marks available and weighting:

Paper 2	Component	Maximum raw mark	Scaling factor	Maximum scaled mark
Part 1 a) 29 marks b) 31 marks	Mathematical comprehension	60	0.5	**30 marks**
Part 2 30 marks	Communicating with mathematics	30	1	**30 marks**

Part 1: Mathematical comprehension.
You should spend about one hour working on this part.

(a) Refer to *Electric cars* in the pre-release material.

1 Refer to the graph in **Figure 4** of the article. Interpret, in words, the speed of the car in the first 35 seconds as it travels from rest in a straight line.

(2 marks)

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2 (a) Find, using the data given in **Figure 3**, the average speed of the car over its first 20 seconds of travel.

(2 marks)

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(b) If the average speed of the car over its first t seconds of travel is 3.3 ms^{-1}, use the suggested model to find t.

(3 marks)

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3 Show calculations that confirm that the speed of the car after 5 seconds is approximately 10.2 ms^{-1}. Use the method given, that is find the average speed in the interval $5.0 \leq t \leq 5.2$, using the function $d = t^2$.

(2 marks)

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4 Show calculations that confirm the statement, "we can see that the value for the speed of the car approaches 10 ms^{-1}" for $\delta = 0.01$ and $\delta = 0.001$.

(4 marks)

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5 (a) Explain why for $15 \leq t \leq 30$ the speed of the car is "simply given by the gradient of the straight line. That is, the speed is 26 ms^{-1}."

(2 marks)

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(b) Explain why the function $d = 26t - 190$ should not be used to predict the distance for $t = 0$?
Support your answer with an appropriate calculation.

(2 marks)

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6 The car in the article appears to have a constant speed of 58 miles per hour for $15 \leq t \leq 30$, where t is the time in seconds that the car has been travelling since starting from rest.
If the model $v = 2t$ held for $0 \leq t \leq 30$, find when it would predict the speed of the car to be 58 miles per hour.

(3 marks)

7 Find, using the model suggested for speed given in the article, the speed in miles per hour, of the electric car after it has been travelling for 2.5 seconds.

(4 marks)

8 Use the models given in the article to find the speed of the car, in miles per hour, when it has travelled a distance of 12.25 metres from rest in a straight line.

(5 marks)

(b) Refer to *Population data* in the pre-release material.

9 The population of the UK at mid-2017 is said to be, "66,040,200 with a confidence interval of +/- 0.2%" and that this is "an increase of 392,000 people since mid-2016".
Use these figures to:

(a) Calculate a possible upper value for the population in mid-2017.

(2 marks)

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(b) Calculate a possible lower value for the population in mid-2017.

(2 marks)

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(c) Comment on the statement about the increase in the number of people in the population from 2016 to 2017 in light of your answers to (a) and (b)

(2 marks)

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10 Show calculations to confirm that the growth rate in the UK population between 2016 and 2017 is approximately 0.6%.

(3 marks)

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11 (a) Calculate the population of
(i) England
(ii) the UK
in 2007 using data from **Figure 7**.

(4 marks)

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(b) Calculate England's share of the UK population in 2007 using your answers found in (a).

(2 marks)

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12 Calculate the number of:

(a) international immigrants in 2016

(3 marks)

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(b) international emigrants in 2016.

(3 marks)

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(c) Hence calculate the net migration in 2016.

(1 mark)

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13 It is suggested that an exponential function might be used to model the population data shown by the graph in **Figure 8**. Explain what you know about exponential functions to suggest why this might be a helpful suggestion.

(3 marks)

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14 Indicate all features that show the 'baby boom' of 1947 on the population pyramid below.

(2 marks)

Figure 9. Population pyramid showing the UK population profile of males and females in 2017 compared to the profile in 2007.

15 (a) Referring to the population pyramid given in **Figure 9**, state how the number of males and females aged 30 in 2007 and then aged 40 in 2017 has changed.

(2 marks)

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(b) Explain what might have been the cause of such a change.

(2 marks)

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End of Part 1.

Part 2: Communicating with mathematics.
You should spend about one hour working on this part.

Refer to *Payday loans* in the pre-release material.

Assume that someone is looking to take out a loan of £250 which they want to pay back after either 1, 2 or 3 months.
They ask you to provide them with some advice about what they might typically expect to pay.

Using between one and two sides of A4, write some advice and include clear calculations that relate to what might be typical loan offers and the associated APRs.

Include a graph to illustrate the total amount paid back, for a typical range of APR values, for a loan of £250 over 3 months.

(30 marks)

There is space on the following pages for your advice and workings, or additional inserts/printouts can be used.

End of Part 2.